



# SUSTAINING BIODIVERSITY CONSERVATION IN AND AROUND NYUNGWE NATIONAL PARK (NNP)

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## Creating Market Instruments to Safeguard Water Availability and Support Conservation of Critical Catchments of Rwanda

**May 2013**

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**A brief progress report on establishing Payments for Watershed Services scheme in Nyungwe National Park, SW Rwanda**

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## Background and Context

Water - in all its dimensions - affects the ability of people to live and thrive in their environments across the globe. Water is essential to everyday life and everyday business- it drives turbines in power stations, it irrigates agricultural land, it processes agricultural and industrial goods, and it is necessary for basic human health. However, our market institutions have failed to safeguard its availability, and today the majority of the world's people live at or on the edge of water scarcity. Those living with the most extreme shortages are impoverished people in developing countries.

Today the growing human populations coupled with climate change are making unsustainable demands on this vital resource that are already outstripping supply in many regions around the world. Simultaneously, the need for agricultural land to feed growing population has led to the destruction of forests and wetlands that have served as water catchments and reservoirs. Half of the world's wetlands have disappeared over the last century, many rivers no longer reach the sea, and over 20% of the estimated 10,000 freshwater fish species are now endangered or extinct.[1] When hydrological services fail, acute and persistent illness like diarrhea can proliferate. Each year, 1.8 million people die from diarrheal disease, 88% of which are attributed to unsafe drinking water and poor sanitation and hygiene.[2] In semi-arid regions, water scarcity is increasing the interaction of human, livestock, and wildlife populations around dwindling water sources, creating ample opportunity for disease spillover among populations and the likelihood of emergence of zoonotic diseases.[3] What is necessary is to shift the perception of water as a free good to water as a service provided by healthy ecosystems and to create market instruments that ensure the availability of water now and for future generations.

The conventional approach taken to water management in the past - which consisted of development, supply and use - has led to improved water accessibility in society, while the water availability in the landscape is continuously declining. Poorly planned and implemented water development projects have produced not only direct, visible effects such as deforestation, swamp drainage, pollution of rivers, lakes and coastal waters but also river depletion, water table changes, groundwater pollution and the degradation of water-dependent ecosystems. Historically, government, donor, and business strategies to deal with the problem of water scarcity have consisted mainly of expanding the physical infrastructure through engineering projects, with an almost complete absence of environmental management instruments. There is an increasing recognition that investments in water development projects (built infrastructure) alone are not sufficient to address the looming water crisis and water resource development should take place within the context of integrated watershed management.

[1] World Bank Group, 2003

[2] UNEP, 2003

[3] Coppolillo, 2009

As many countries move toward their commitments under the Millennium Development Goals[4], there is a growing understanding that without environmental sustainability (MDG7), many other MDG targets are unlikely to be met. Indeed, the Millennium Ecosystem Assessment suggested that "any progress achieved in addressing the goals of poverty and hunger eradication, improved health, and environmental protection is unlikely to be sustained if most of the ecosystem 'services' on which humanity relies continue to be degraded".

## Role of water in Rwanda's economic development goals

Accessibility to water and land resources for agriculture and grazing areas are key factors for sustainable development and sustainability of rural livelihoods. These factors represent some of Rwanda's most important resources on which the livelihoods of the poor are critically dependent. Rwanda is Africa's most densely populated country and depends heavily on surface waters for agriculture, domestic uses, and energy production. Maintaining its water resources in lakes, rivers, critical catchments and wetlands is critical for Rwanda's social and economic development as articulated in its Vision 2020 (MINIRENA, 2011).

Rwanda's Vision 2020 document, describes the basic development objectives of the country over the long term. It is the key socio-economic policy document on which all national and sectoral policies and strategies are based and on the basis of which the allocation of resources between the various sectors is made. It establishes the modernisation of agriculture and animal husbandry as one of six pillars supporting its aspiration to "build a diversified, integrated, competitive and dynamic economy, which could raise the country to the level of middle income countries." It is anticipated that the sources of agricultural growth will be of two types: (i) those which are linked to regional and international export potential through commodity chains (tea, coffee and pyrethrum), in some cases for relatively new products, and (ii) those which are related to internal market development, essentially the cereal commodity chains (rice, maize) and milk, meat and vegetable crops. Also building on achievements and lessons learned during the implementation of Economic Development and Poverty Reduction Strategy (EDPRS I), EDPRS II is being developed around thematic areas reflecting Rwanda's emerging development priorities. These emerging priorities are: (1) Economic Transformation, (2) Rural Development (3) Productivity and Youth Employment and (4) Accountable Governance. In addition under the EDPRS II is envisaging a target of 11.5 % annual growth rate.

It is undeniable that the targeted economic growth coupled with population growth, competing demand for water by various economic sectors will put additional pressure on freshwater resources and other natural resources. A closer look at the water requirements for producing priority crops) under the

[4] The Millennium Development Goals (MDGs) are eight goals to be achieved by 2015 that respond to the world's main development challenges. These include: 1) Eradicating extreme poverty and hunger, 2) Achieve universal primary education, 3) Promote gender equality and empower women, 4) Reduce child mortality, 5) Improve maternal health, 6) Combat HIV, malaria and other diseases, 7) Ensure environmental sustainability, and 8) Develop global partnership for development.

"strategies for sustainable crop intensification in Rwanda" shows that Rwanda's economic growth will be constrained by water limitations. By 2017 Rwanda will need between 1.6 to 2.5 billion $m^3$ of water to reach its expected agriculture targets without mentioning water demand for electricity production and other industries. Table 1 shows the virtual water content[5] by priority crop in Rwanda.

Although the Rwanda is endowed with abundant surface and groundwater resources, the effective and management of this resource has remained critical. One of the main challenges in managing the Rwanda water resources is related to land and ecosystem degradation, forests, wetlands, savannah.

Water sub-sector in Rwanda faces in number of challenges including:

a) **Land degradation and water pollution:** Land degradation that results in loss of soil fertility and siltation of water resources downstream is the primary cause of the degradation of Rwanda's water and forest resources particularly protected areas that constitute major catchments of the country. Land degradation is mainly caused by poor land use practices, and mining activities. Declining water quality is a challenge to WRM because it reduces access to and use of water, and increases the cost of providing water services (domestic water has to be treated; sediment loads reduce functionality and increase water treatment and maintenance costs).

b) **Growing water demand amidst high population growth and climate change:** Population growth is a major challenge to meeting water demand. Within the 2 basins, Rwanda's population density is the highest 400 persons per $km^2$ on the Congo side (UNEP, 2010) and projected to be 515 persons per $km^2$ on the Nile Basin side by 2015 (NBI, 2008).

c) **Inadequate and reliable financing:** Most of the public investments in the water sector have focused on water supply infrastructure, irrigation and hydro-power development. Very little funds have been invested in catchments management.

Restoring degraded lands and avoiding degradation of remaining intact landscapes is a critical way for Rwanda to achieve its goals of improving water quality and quantity that will support economic development in the country. A key place for such action is in Nyungwe National Park (NNP), one of the core landscapes in the Albertine Rift. The Nyungwe landscape plays a vital role in intercepting precipitation, filtering run-off, and mediating water quality into Africa's two largest hydrological networks- the Nile and Congo basins- which the park straddles.

[5] Virtual water content is the amount of water that is embedded in food or other products needed for its production.

Table 1. Priority crops under sustainable crop intensification program and their virtual water contents

| Crop varieties | Surface area (2012) | Average production (ton/ha/year) | Total production per year (ton/year) in 2011 | Virtual water content (m3/ton)[6] | Projected expansion of land area (ha) in 2013[7] | Projected productivity (t/ha) by 2017 under different scenarios | | Total projected demand for water (virtual water content) (m3) by 2017 | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Business as usual | Moderate or extreme growth | Business as usual | Moderate or extreme growth |
| Tea | | | 24,000 | 10,394 | | | | 249,456,000 | 249,456,000 |
| Coffee | | | 21,000 | 17,629 | | | | 370,209,000 | 370,209,000 |
| Rice | 18,000 | 4.1 | 10,068 | 2,500 | 20,000 | 4.1 | 6 | 205,000,000 | 300,000,000 |
| Maize | 261,000 | 1.94 | 4,553 | 450 | 286,413 | 1.94 | 5 | 250,038,549 | 644,429,250 |
| Wheat | 57,148 | 1.7 | 3,963 | 1,150 | 62,862 | 1.7 | 4 | 122,895,210 | 289,165,200 |
| Irish potatoes | 251,148 | 10.2 | 23,214 | 160 | 277,145 | 10.2 | 15 | 452,300,640 | 665,148,000 |
| **Total** | | | | | | | | **1,649,899,399** | **2,518,407,450** |

[6] Sources: Myers, N and Kent, J. 2001. Perverse subsidies: How tax dollars can undercut the environment and the economy.

[7] MINAGRI (2011). Strategies for Sustainable Crop Intensification in Rwanda

## Create Market Instruments to Safeguard Water Availability in Nyungwe National Park

The development of Payments for watershed services in Nyungwe aims at addressing some of the challenges facing conservation in Rwanda including secure sustainable financing and support local livelihoods by developing best practices for sustainable development. Specific objectives are:

1. To partner with private sector to develop new business models that incorporate ecosystem services approach into business planning, investment and decision-making;

2. To promote and implement innovative solutions and policies such as payment for watershed services to support local community livelihoods and conservation of water catchment areas;

3. To develop and communicate key messages and frameworks for improving understanding of the importance of ecosystem services (water quality and quantity) and of what we need to do to maintain and enhance the ecosystems that generate them.

Market-based mechanisms for the provision of environmental services are thought to offer potential in several ways. They can complement regulatory approaches, or they can become the key tool to deal with environmental problems in the absence of a regulatory framework. They also appear to offer a way of improving livelihoods, or at least lessening the adverse livelihood implications of land-use restrictions. Because individual upstream land users reap most of the benefit and pay little of the costs caused by land uses that degrade water services, they have little economic incentive to change such practices. However, having downstream water users provide upstream land users with payments for environmental services (PES) could provide such incentives.

## Why Nyungwe National Park?

In addition to its biodiversity values, the NPP is highly important for the well being of its surrounding human population. It is the largest protected forest in Rwanda and provides vital ecological services, via water catchments, for the majority of the country and stabilizes soil erosion for the surrounding communities. Nyungwe acts as the water catchment for about 70% of Rwanda (approx: 6,500,000 people) and together with Kibira supply water to a major hydroelectric power plant that produce 90% of electricity consumed in Burundi. These services largely fall into four broad categories: water filtration/purification, seasonal flow regulation, erosion control and sediment control; habitat preservation. Preliminary economic assessments of some of the most important ecosystem services provided by Nyungwe has suggested their collective value at approximately US$290 million/year, with watershed services valued at US$ 117,757,583 (Masozera, 2008).

Landlessness, decreasing agriculture productivity as a result of land degradation outside the park, and lack of alternative economic opportunities are significantly affecting the management of the park. Illegal mining, poaching, encroachment for agriculture land are affecting the integrity of the park and its

ecosystem services. In addition, the park's budget is insufficient to meet the needs identified in its management plan. Therefore, ecosystem conservation efforts and the possibility of offering alternative sustainable economic activities to local communities are also insufficient. This has revealed the long-term risk in maintaining its biodiversity and in the supply of good quality water for people living around the park who are dependent on this important resource.

Over the last two decades Rwanda has taken important strides to improve the management of its protected areas, and to utilize tourism as a way to generate the revenues to finance them and support community development projects. Today gorilla tourism represents the primary source of revenue available to finance park operations in addition to donor's supports. However growth in gorilla tourism revenue directly benefiting other protected areas faces a constraint – the number of gorilla permits available on a daily basis. Also given the uncertainties of the global tourism industry—driven by factors such as the state of the global economy, the price of air transport due to fluctuations in oil prices, and the perceived state of international security—revenues from tourism seem to be unpredictable. Therefore there is an urgent need to diversify sources of revenues to address this uncertainty.

NNP partners, including USAID, Wildlife Conservation Society (WCS) and the Rwanda Development Board (RDB), are exploring the application of sustainable financing mechanisms like payment for ecosystem services (PES) as a means to protect and enhance the services and values provided by NNP while securing benefits to the adjacent communities.

There are several steps involved in designing Payments for watershed services scheme including the development of a concept and idea for PES, technical feasibility analysis and PES implementation through negotiations and agreements between providers and users. The next sections describe steps involved in creating markets for watershed services, progress made, and highlights key accomplishments in designing a PES scheme in Nyungwe and future actions.

## 1. Develop the concept and idea for payments for ecosystem services

The first step in creating a PES scheme is to identify the ecosystem services that will be the structural basis for the PES and will determine many aspects of the following steps for its operation. This will help clarify the issues and needs of the specific area where PES will operate.

### *1.1. Identification of strategic ecosystem services*

Determining one or more strategic ecosystem services to create a PES scheme is important in establishing conservation priorities that will improve the health of one or more ecosystems and, at the same time, support the availability of other services such as biodiversity, carbon sequestration and recreation.

In moving forward three initial questions have to be asked:

1. Which strategic ecosystem services will the PES protect, conserve, restore, fund and/or compensate? In other words, where is the opportunity to fund long-term conservation that benefits all parties involved?

2. Who are the key stakeholders — in other words, large water users — that have a particular interest in the preservation of those ecosystem services? How can we demonstrate the value of these environmental services so that it can be internalized as a cost-benefit function?

In the case of Nyungwe National Park there are key hydrological services that benefits from its conservation:

- Regulating the water cycle, maintaining base water flows, regulating high flows (peaks).
- Maintaining or improving water quality (i.e. water without pollutants).
- Maintaining and controlling sediment loads.
- Maintaining or improving aquifer recharge.

The identification of hydrologic services that must be conserved or recovered is a very important step that helps identify key stakeholders that should be involved and develop strategies for achieving the goals and objectives set for the PES.

### *1.2. Stakeholders analysis*

As a next step in setting up a PES scheme, it is necessary to analyze the stakeholders present in the area that eventually will have a direct or indirect relationship with the mechanism. This exercise is of the utmost importance as it will help identify who are, or could be, the most interested in maintaining or recovering ecosystem services and, therefore, become partners and contribute financial resources to the fund.

Engaging key stakeholders is critical at early stages of PES development because some of the stakeholders including government officials may not embrace and accept these (imported) concepts due to several reasons:

- There is a general perception that water scarcity is primarily an infrastructure investment problem, dismissing the role played by natural capital
- Many potential “buyers” such as tea estates and cement production company have been receiving services without cost, therefore they may refuse to accept paying a cost, and resist the establishment of markets
- Many beneficiaries view water, as a benefit the state has an obligation to provide. They also feel that water costs are already too high and would not accept higher rates in order to pay for watershed management.

The key stakeholders in a PES scheme are essentially the largest consumers of the water resources. Participation of consumers is key whether for reducing treatment costs or in the interest of guaranteeing the availability and quality of water for a specific use, such as industry, energy, agriculture or human consumption. These major consumers, who can be either from the public or private sector, form the basis of the PES in terms of providing the main financial resources for its establishment.

WCS carried out a stakeholder’s analysis and table below summarizes each organization interest in participating in PES.

Table 2. Potential stakeholders of PES scheme in Nyungwe National Park

| Sector | Stakeholders | Interest in participating in PES |
|---|---|---|
| **Public** | EWASA (water and hydropower generation) | Water quality, water regulation, avoided sediment costs. |
| | Rwanda Environmental Management Authority (REMA) | Environmental compliance, resource conservation. |
| | RDB- Tourism and Conservation | Strengthening, financing and fulfilling protected area management plans, resource conservation. |
| | FONERWA | Strengthening, financing and fulfilling protected area management plans, resource conservation. |
| | Rwanda Natural Resources Authority (IWRM department) | Management of watersheds, resource conservation. |
| | Ministry of Agriculture (Irrigation projects | Water regulation, avoided sediment costs. |
| **Private** | Micro-Hydropower operators | Water regulation, avoided sediment costs. |
| | Agricultural associations (e.g. Rice irrigation associations) | Water regulation, avoided sediment costs. |
| | Tea factories | Water quality and regulation, |
| | Coffee processors (coffee washing stations) | Water quality and regulation |
| | CIMERWA (Ciment production) | Water regulation |
| | Tour operators | Landscape beauty |
| | Hotels | Water quality, landscape beauty |
| **Academic** | National University of Rwanda | Research development/conservation |
| **Local community** | Water users associations | Water quality, water regulation, avoided sediment costs. |
| | Local associations/cooperatives/NGOs | Participation, resource conservation |
| **International organizations** | USAID | Poverty alleviation, development and conservation |
| | Dutch cooperation | Poverty alleviation, development and conservation |
| | Wildlife Conservation Society (WCS) | Development and conservation |

The analysis went further in determining the level of influence each stakeholder group may have on the PES scheme. Table 3 summarizes the findings.

Table 3. Levels of interest and influence of different stakeholders on a potential PES scheme in Nyungwe National Park

| | | |
|---|---|---|
| **Level of interest in PES scheme** | Private sector:<br>Tea factories<br><br>Private hydropower operators<br><br>CIMERWA<br><br>Multilateral cooperation agencies (USAID, DUTCH)<br><br>National University of Rwanda<br><br>International NGOs (WCS)<br><br>Hotels | MINAGRI (irrigation department)<br>Local NGOs<br>RDB – Tourism and Conservation<br>EWSA<br>FONERWA<br>RNRA |
| | Private sector not related to water:<br>Tour companies | Local government<br><br>Land owners |
| **Level of influence in the PES scheme** | | |

As shown in the table 3 above, a stakeholder located in the upper right-hand box represents a stakeholder with a high interest in the PES and also with a high degree of influence on it. This combination justifies these stakeholders' participation in the PES from the beginning. A stakeholder in the lower left-hand box with a low interest in the water fund and a low level of influence (even if it is considered an important potential participant in the fund) is not crucial at the beginning of the water fund creation process. That stakeholder's involvement can be negotiated in the medium term.

Ecosystem services cut across all the economic sectors including health, energy, water, agriculture etc. To ensure ownership and buy in of the process of designing a PES and the key findings of the feasibility analyses it is important to establish/create a national task force on PES. Based on the findings of the

stakeholders analysis a national task force was formed and is currently led by REMA. The main functions of the functions are as follow:

- Preparing a work plan that includes a detailed timeline
- Conducting meetings to coordinate strategies and define next steps.
- Analyzing and developing ToR for initial technical studies.
- Informing stakeholder institutions about the status of the PES development.
- Analyzing and facilitating the incorporation of new members to the task force.

The members of the task force are EWSA, REMA, WCS, RNRA / Forestry and Nature Conservation, RDB, and Private sector federation.

WCS, USAID, RDB and others have spent considerable time raising the awareness of the need for a sustainable financing mechanism for NNP. Outreach activities are generally focused on three major groups of constituents: private sector, governments and communities. Though WCS and RDB have led workshops and informal communications with the private sector for years, the recent survey was the first attempt to formalize this engagement. The survey aimed to 1) identify the primary beneficiaries, 2) assess their interactions with and perceptions of NNP and its management, 3) capture beneficiary understanding of the threats, trends and connection between ecosystem service and business risk and 4) identify interest in continued engagement. The survey had particular focus on hydrological services provided by NNP. WCS sent the survey to 45 stakeholders; selected based on the benefits they may receive from Nyungwe Forest and the potential impacts they have on Nyungwe Forest (Masozera personal conversation). 30 stakeholders responded, and the results and take-aways are covered in the WRI report "Nyungwe National Park Survey Results" which is available upon request. Tour companies comprised a vast majority of the invitees who did not participate in the survey. Every single business surveyed is interested in helping to protect the Park in some way and would be interested in learning more about investing resources in the improved management of natural areas like the Park. More than 60% of businesses explicitly stated that each of these interests exists because the Park benefits their business.

Though the November 2012 stakeholder discussions were quite informative and productive, they were moved from NNP to Kigali. A vast majority of the participants were government officials. Though a few beneficiaries did participate, including a representative from the largest tea plantation and tourism board, more focused engagement with the private sector is critical if contributions towards NNP management are expected. Beneficiaries are less likely to speak freely with government officials in the room. A private sector working group, composed primarily of business operators located around Nyungwe, had previously been established and met once during 2011. It was suggested that the "members" of this private sector working group be reconstituted and potentially expanded to include Kigali based tour operators and other Nyungwe relevant business, to meet once a quarter to:

1) Ensure there is a direct mechanism for continued engagement and outreach;
2) Provide beneficiaries with updates and results on the items outlined above;

3) Close knowledge gaps ;
4) Help them share perspectives with others and motivate action;
5) Identify private sector champions; and
6) Assess willingness to pay through:
    a. One-on-one engagement around the business case for partnership and investment
    b. Cost-benefits analysis of land use change for each sector/beneficiary

Establishing a private sector working group would facilitate action, help address gaps in awareness and understanding and catalyze progress towards a large-scale sustainable financing mechanism. This group could operate independently from, but synergize work with, the national task force. Without the government in the room, business leaders will be able to talk more freely about issues surrounding ecosystem services used by their operations and the challenges to developing a sustainable financing mechanism that meet the needs of the business community.

Physical mapping of the beneficiaries is a key next step in order to understand how businesses' location in the landscape relates to their use and perception of ecosystem services and to their potential motivations to make investments. Figure 2 offers a preliminary sketch of survey respondents' locations in relation to Nyungwe and the river networks that convey watershed services throughout Rwanda. This

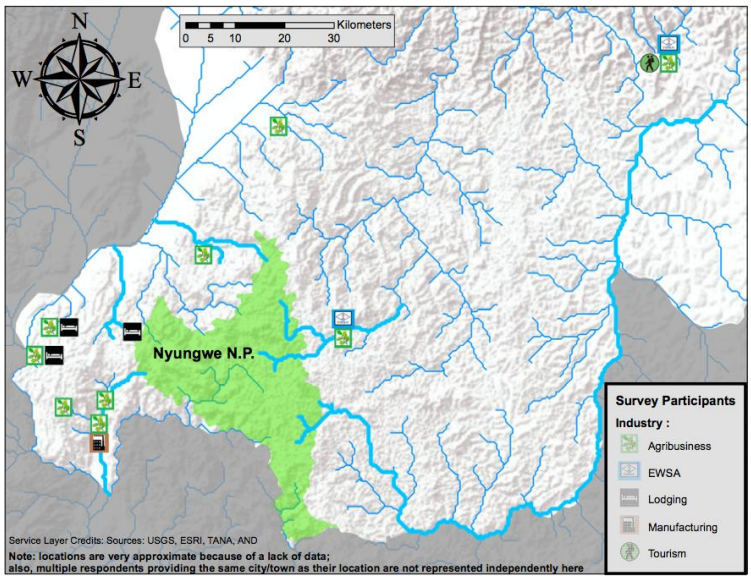


**Figure 2.** Preliminary mapping of a subset of survey respondents shows that numerous participating businesses, representing all industries, are located on river networks that receive water directly from Nyungwe National Park (bolded river channels). The locations of participating businesses are very approximate; future efforts should include a more formal analysis with higher quality data. [*Note: all mapping was done with Esri's ArcMap 10.0 software*]

example demonstrates what a mapping project might look like, though it is solely for illustrative purposes. Both the extension of this sketch into a formal GIS analysis and the detailed mapping of ecosystem services supplied by Nyungwe would be highly valuable.

The relevance of beneficiaries' physical locations was highlighted during stakeholder conversations: there was much discussion around Nyungwe being the headwaters for both the Nile and the Congo and, consequently, about the services that are being provided beyond not only the boundaries of the Park but also the borders of Rwanda. While perceptions of service provisioning and threats generally drop

with increasing distance downstream, addressing sustainable financing in Rwanda sets the stage for potential future discussions across national boundaries.

## 2. Technical feasibility analysis

The next phase in the design of a PES requires preparing a series of studies to define technical, legal and financial feasibility. High quality studies are important and will help provide solid conclusions about PES's potential economic, social and environmental benefits. The level of depth of these studies may vary, however, depending on the amount of information available, financial resources, interest of users in creating a PES scheme and knowledge of stakeholders of the watershed's ecosystem services, among other topics[8].

Over the last two a number of technical feasibility analyses have been undertaken including the hydrological modeling and the review of legal and institutional framework for PES development in Rwanda.

### *2.1. Hydrological modeling*

In carrying out the hydrological modeling we specifically aimed to answer the following questions:

1. What are the hydrological responses resulting from different land use practices on total streamflows, either within a specific sub-catchment, or accumulated downstream from the headwaters to the exit of the entire catchment?

2. What effect do different land use practices have on sediment yield (i.e. erosion of soil reaching the stream and being transported downstreams)?

3. How do these responses vary between wet and dry seasons? What are likely to be the impacts of climate change on Nyungwe hydrology?

4. Are there certain areas within Nyungwe where the impacts are more severe than elsewhere, either because of physiographic characteristics (e.g. slope and/or soil properties)?

To answer these questions, WCS has engaged with the US Forest Service to carry out a watershed assessment using the Water Supply Stress Index- Carbon and Biodiversity model (WASSI-CB) and the Integrated Valuation of Ecosystem Services and Tradeoffs model (INVEST)[9]. The models focused on

[8] TNC (2012). **WATER FUNDS** CONSERVING GREEN INFRASTRUCTURE. A GUIDE FOR DESIGN, CREATION AND OPERATION

[9] WASSI-CB is an integrated, process-based model that can be used to project the effects of forest land cover change, climate change, and water withdrawals on river flows, water supply stress, and ecosystem productivity (i.e. carbon dynamics). WASSI-CB was developed by USDA Forest Service. INVEST is a series of models to map and value nature's goods and services that are essential for sustaining and fulfilling human life. **It** is a tool developed by the Natural Capital Project, a partnership between Stanford University's Woods Institute for the Environment, the University of Minnesota's, Institute on the Environment, TNC, and World Wildlife Fund.

evaluating the impacts of land use practices and climate change on water quality and quantity. The potential impacts were evaluated through four scenarios: a baseline, deforestation, one degree Celsius temperature increase, and the combination of a one degree Celsius temperature increase and ten percent reduction in precipitation. The conclusions from the scenario runs suggested that due to global climate warming, specifically increases in temperature and reductions in precipitation would cause decreases in stream flow, conversion of forest to cropland would have minimal impact on stream flows, deforestation would greatly increase erosion and sedimentation, and that Nyungwe has relatively high water yield, 30%-40% of its annual precipitation, and due to steep slopes and high rainfall, deforestation within Nyungwe would cause serious sedimentation problems. The conclusions were informative and insightful, but have not been validated with field data. Year 2012 our efforts were more focused on collecting local site specific data for models validation. We expect to complete the model validation by the end of April 2013. These tools will enable stakeholders to understand the impact to critical ecosystem services under a variety of management/land use change scenarios. Moreover, there is an institutional propensity to act tomorrow on the critical issues facing our communities like securing water supply, rather than deal with clear emerging issues today. This effort will help articulate what that future may look like if a preventative strategy is not adopted. The modeling exercise will help to understand which areas deserve priority intervention for generating, for example, sediment control, increased water supply, or better water quality, among other benefits.

In September 2011, we convened one of the first meetings in the region on watershed modeling and management (information can be found at http://rmportal.net/library/content/translinks/2011/wildlife-conservation-society/2011-Watershed-Modeling-and-Management-Workshop-Rwanda). We brought together stakeholders, Government representatives, local researchers, and natural resource managers from Rwanda and 13 other African countries to review preliminary results from the analysis and to solicit feedback on how we could adjust the methods, scenarios, and models to better reflect water resource realities in Rwanda/the region. WCS continued working with USFS in 2012 would like to complete this research by validating the results of the scenario runs in the Nyungwe National Park and to revise some of the analyses after receiving feedback and input on the preliminary results from stakeholders in Rwanda. The validation and further analyses currently being carried out include the following:

1) Comparing the modeled runoff estimates and modeled sediment export estimates to measured stream flow and sediment loss.
2) Comparing the WaSSI-CB modeled evapo-transpiration and gross primary productivity to MODIS derived evapo-transpiration and gross primary productivity.
3) Comparing global climate data with climate measured at weather stations within Rwanda
4) Rerunning the WaSSI-CB model with flow routing on the entire park including the portion that is in Burundi.
5) Rerunning both models using local soils and land use derived from aerial photograph.
6) Redefining the climate change scenario and running both models with those scenarios.

Once the validation is completed we will ensure that the results of this work reach decision makers and that they have the opportunity to explore with WCS and USFS researchers the limitations and potential applications of the results for policy and management. In addition, we would like to use this opportunity to continue building watershed management capacity and leadership within the country. Thus, the following activities will be carried out:

a) **Dissemination workshop**: The purpose of this half-day workshop would be to disseminate the final results of the project to decision makers. Many of these people will have attended the first policy workshop and, so, will be eager to see the final results of the project and explore with the USFS staff ways in which they can and should use the final results for application in watershed management and policy in Rwanda.
b) **Technical Training Workshop:** With USFS, WCS would also like support to conduct a two-day follow-up technical workshop, consisting of approximately 20 participants, in Rwanda on using WaSSI-CB and InVEST models. The purpose of this workshop would be to give attendees to the first training workshop an opportunity to receive follow-up training and support on using the models for water resource management.
c) **International Dissemination:** Results from this work will be presented at international scientific conferences and per reviewed scientific journals.

*2.2. Socioeconomic Analysis*

Among the technical studies that are necessary for creating a PES scheme is developing a component that will help value environmental services and promote the inclusion of environmental costs in decision-making by the PES's partners. The PES scheme should represent an attractive option for its partners in terms of environmental, social and economic benefits. It is important to determine what those benefits are, based on biophysical information, and to include clear indicators of the socioeconomic aspects that should translate into benefits for the partners as well as for the ecosystems in general. This involves identifying the business opportunities that will make a positive difference in the watershed and, who should pay, and how much should be paid for those environmental services.

NNP's ecosystem services are highly valued across economic sectors -- 80% of survey respondents, including all agribusiness representatives, stated that their business' success relies on at least one of the major watershed services described in the survey and perceive an important role of the Park in provisioning such services.

Current farming systems and agricultural practices around Nyungwe are unsustainable over the long-run and are leading to accelerated degradation of land and water resources, with consequent decline in soil productivity and increasing pressure on resources from the national park. Farmers have poor technical knowledge and lack the capacity to invest in new technologies (low income, inadequate access to credit and extension services). Crop production is often realized on fragile steep slopes and using techniques that result in insufficient ground cover during the rainy season. These problems coupled with population growth are leading to increasing pressure on natural resources from the park through conversation of forest to farmland, mining, poaching etc. Such conditions lead to high sediment loads in water courses,

with subsequent reduction in water flows, increase in water turbidity and overall decline in water quality for downstream users.

Moving out of the vicious cycle of land degradation, poverty and forest degradation inside the park will require better forms of production, such as Sustainable Land Management (SLM) techniques, that can foster a more efficient water use and reduce pollution problems, contributing to an increase in the quantity and quality of water available. Nevertheless, one of the key barriers for wider adoption of SLM is designing the proper incentives and technical support systems to stimulate the adoption of such practices. Payment for Environmental Services (PES) schemes are one policy option for bridging this gap by providing incentives to upstream farmers that are consistent with the benefits they provide to downstream counterparts.

WCS is currently conducting a land degradation assessment in Nyaruguru district to establish a baseline of current land use practices, soil conditions and land cover and assess SLM that fits the socioeconomic and geographical context of the area. In practice accurate screening of viable options is frequently either ignored or done solely by specialized researchers and experts. In the context of Nyaruguru district WCS is assessing the most viable SLM options and factors influencing their widespread adoption from the perspective of farmers and scientists from Rwanda Agriculture Board. Once the most preferred options are identified and factors influencing their adoption are known the next steps would be to assess the costs of their implementation. This information will be the basis for assessing the incentives needed for upstream farmers that are consistent with the costs of implementing SLM and the benefits they provide to downstream counterparts.

A cost/benefit analysis would help create the connection between increased threats and associated degradations to the business operations of NNP beneficiaries. Unless a beneficiary can see the direct risk to their business model, it may be unreasonable to expect them to contribute towards interventions. This analysis would help articulate the economic tradeoffs associated with the land use scenarios highlighted in the modeling exercises, and should strengthen the business case for willingness to pay into a sustainable financing effort.

### *2.3. Legal and Institutional analysis*

The PES scheme's transparency, independence and long-term permanence must be justified in a study that analyzes the different legal and institutional alternatives for its structure and operation[10]. Countries such as Rwanda have relatively recent environmental legal frameworks or are in the process of establishing them. It is very important to understand these legal frameworks to avoid conflicts in the PES proposal. On the contrary, the water fund should contribute and complement plans, programs and projects that different governments have established in their environmental policies.

[10] TNC

The April 2012 report "Review of Institutional, Legal and Policy Frameworks for Developing Payments for Ecosystem Services in Rwanda" discussed a policy and legal framework for PES (watershed management) in Rwanda.

Overall, the review established that Rwanda has "generally young laws, policies and institutions for the management of its natural resources and the environment." Arguably the greatest benefit to a PES policy and Task Force is to "bring clarity of provisions from very many laws, regulations, orders, and practices into a single platform of reference necessary in attracting and guiding investments into PES schemes particularly at this time with uncertainty of climate change. This will save a lot of time and money."

The report also states that currently, "the laws, policies and strategies are only falling short of ingredients that would make PES schemes operational and cost-effective." Recommendations from the report are aligned with major take-aways from the November stakeholder discussions and include:

1.) Defining priorities;
2.) Identifying big water users;
3.) Creating conditions and a forum for continued engagement; and
4.) Creating an institutional framework that consistently links the providers of ecosystem services with the users.

The Task Force should focus on the roles and steps that need to be performed to work towards implementation.

*2.4. Development of NNP Business Plan*

Payments for Ecosystem Services (PES) are an effective tool to satisfy the financial needs of protected areas. Many of them already have management plans in place, but in most cases they lack the financial resources to implement them. Once with key PES stakeholders identified, it is important to carefully explore existing management plans and how the PES could partially or fully contribute to financing them. This is done by developing a sustainable finance (business) plan. A sustainable finance plan is a plan that will ensure that the full costs of a protected area system are met, both now and into the future. A sound financial plan should ensure that the growth of income matches or exceeds the growth of expected costs of managing NNP. Putting together a plan will require:

- Identification of current and projected costs of managing NNP;
- Identification and quantification of current revenues and gaps; and
- Development of revenue generation scenarios

WCS, USAID and WRI are in the early stages of discussing the need and work plan associated with a business plan focused on sustainable financing for NNP. Though not all of the steps may be possible at

this time, below is an example of the basic steps in assessing the sustainable finance needs for a protected area system:

- Conduct a financial gap analysis of current income versus expenditures, differentiating between basic and optimal costs, and including the costs of improving protected area management.
- Assess protected area management and capacity needs by identifying key threats and management weaknesses in the existing system, and identifying critical capacity needs.
- Develop cost estimates for the management needs over a ten-year time horizon, including minimum, medium, and ideal growth scenarios.
- Screen and assess existing and new funding mechanisms to address financial gaps, including an assessment of how fiscal and management reforms might reduce overall expenditures.
- Formulate financial plans at system and site levels, with multi-year action plans, including strategic funding mechanisms, resource allocations, fiscal and management reform opportunities, management and capacity building needs, and the implementation plan.
- Implement the action plans. This process will entail close collaboration and coordination across multiple government agencies and departments, particularly when developing annual budgets and work plans.
- Measure progress and adapt the sustainable finance plan regularly, particularly as new funds become available and as priorities shift over time.

One of the challenges in developing a business plan is the availability and accessibility to financial records of park authorities. In the past attempts to development business plans for protected areas have failed due to difficulties of obtaining financial details (data) of ORTPN. As the business plan is critical to financial sustainability of parks management we hope RDB – Tourism and Conservation will play an important role in obtaining the necessary information.

### 3. Sustainable Financing Mechanism/PES Implementation

The first two steps will help build the foundation for a sustainable financing mechanism. Biophysically, these efforts will identify baseline conditions, threats, trends, priority areas and associated interventions. Economic analysis will highlight potential lost value and business risk under a variety of land-use change scenarios. And infrastructure-related steps will focus on engaging the necessary stakeholders and setting up the appropriate policies through new and existing institutional arrangements. This will take time. A lot can be learned from viewing how other countries have addressed similar endeavors, but realistically, this is a multi-year process. Stakeholders need to identify interim benchmarks to ensure progress is being made and adapt as necessary.

The institutional arrangement, especially around the role of FONERWA, will have major implications on how a sustainable financing mechanism would be implemented. When appropriate, it will be critical to

develop the protocols and standards governing how the system will operate. MOU's should be developed between supply (NNP and communities), demand (beneficiaries and other sources of funds) and government agencies agreeing to the framework. This will set the stage for the first payments/set of incentives.

## 4. Monitoring, Verification and Evaluation

Once financing begins to flow, it will be critical to monitor both on-the-ground and process-related outcomes.

- *Biophysical Monitoring*

Ecological change takes time. Therefore monitoring should be performed at multiple levels:

1. Practices - Changes in trends related to threats
2. Outcomes - Gaging Stations to monitor water and sediment flows installed at different sites in Nyungwe watershed

- *Socioeconomic and Economic Monitoring*

Success will be measured both inside the park boundaries and in the surrounding communities. Long-term NNP health will only be achieved if communities value the park as an asset and feel they benefit from how it is operated. Therefore, monitoring should also look at the following indicators of success:

1. Anecdotal community behavioral changes
2. Adoption of sustainable land management practices

- *Adapt Process*

Just as monitoring, evaluation, and adaptation are fundamental pieces of on-the-ground management, they will also be critical to the success of a sustainable financing mechanism. The Task Force or advisory team will need to set clear metrics and indicators of success and audit progress at defined intervals against expected outcomes, drawing on examples of how other countries have incorporated program evaluation into their ongoing operations.

## 5. Document and share lessons learned

## 6. Build the capacity and replicate the model

NNP can learn a great deal from how other countries and protected areas have addressed the steps and challenges associated with developing sustainable financing mechanisms. There is no silver bullet or exact approach. As such, it will be important to consider successes and missteps from abroad, as well as to document and share their own successes and missteps both internally and to external audiences, in order to create institutional capacity for replication over time.

**Priority next steps:**

Immediate next steps should focus on:

1.) Reconvening the PES Task Force to redefine the scope (to cover sustainable financing more broadly) and agree on new additional members
2.) Agreeing upon a work plan with clear deliverables, roles and responsibilities;
3.) Ensuring coordination amongst the a) various agencies and other stakeholder and b) the variety of efforts already underway that have a common theme of NNP protection and financing (currently, this is a major missed opportunity); and
4.) Thinking strategically towards implementation of the PES consultant document, taking ownership of the process and recognizing how sustainable financing can benefit agency mission.

*PES is just one of many sustainable financing tools used to ensure adequate funding for protected area management. As the government task force reconvenes, they may consider a review of the suite of mechanisms that have been utilized in other countries.

Once the Task Force reaffirms its vision and work plan, immediate emphasis should be placed on the following tasks:

1.) Review best practices from select countries who have successfully achieved similar undertakings
    a. For example - The lessons from the usually quoted Costa Rica example are that (i) a package of incentives rather than one type of incentive was necessary to secure PES, (ii) external support was catalytic in getting it off the ground, and (iii) it takes time to realize the ultimate outcome e.g. reduced deforestation and human development index. The implication is that PES schemes must continue to be supported by strong national institutions and commitments, and supported with bio-physical scientific evidence.
2.) Analyze demand drivers
    a. Are there any policies currently in place
    b. Are any new regulations or policies warranted
3.) Agree upon institutional arrangements
    a. FONERWA role - Rwanda is well positioned for having agreed to set up the National Fund for environment and climate change (FONERWA) whose main mandate is to solicit and manage funds and provide incentives. It could therefore consider creating a portfolio for a sustainable financing mechanism under its operations. However, it became clear during the November discussions that there is a lack of clarity regarding FONERWA's role, management and effectiveness. A new institution, if crafted correctly, provides a wonderful opportunity to move things forward. Perhaps the PES Task Force can operate as an advisory or governing board for FONERWA. More transparency is needed.
    b. Collection and distribution of dollars/incentives – It should be clarified early on who will have responsibility for collecting, housing, disbursing and reporting on funds. Processes need to be established that ensure transparency and third-party verification of the process, including:
        i. To whom will the funds go
        ii. Where (priority locations)

iii. For what interventions

The steps described above will allow these decisions to be science/merit based and transparent.